

**REMARKS**

These amendment and remarks are filed in response to the Office Action mailed January 31, 2007. For the following reasons, this application should be allowed and the application passed to issue. No new matter is introduced by this amendment, as only claims have been canceled in this amendment.

Claims 1, 5, 7, 14, 16-18, 20-24, 26-34, 36, and 37 are pending in this application. Claims 33, 34, and 37 were withdrawn pursuant to a restriction requirement. Claims 1, 5, 7, 13, 14, 16-32, 35, and 36 were rejected.<sup>1</sup> Claims 2-4, 6, 8-12, and 15 were previously canceled. Claims 13, 19, 25, and 35 have been canceled in this response.

***Claim Rejections Under 35 U.S.C. § 112***

Claim 5 was rejected under 35 U.S.C. § 112, second paragraph as allegedly being indefinite. The Office Action alleged that was unclear as to what median size  $D_{50}$  based on volume means. This rejection is traversed, and reconsideration and withdrawal thereof respectfully requested.

As is known to one of skill in this art, "median size  $D_{50}$  based on volume" refers to the particle size when the cumulative value is 50%, in the cumulative particle size distribution determined based on volume. As is well known in this art, count-base and volume-base can be used as the basis of the determination of the particle size distribution. Additionally, it is common to use the particle size at the time when the cumulative value is 50% (median size) as the average particle size in the field of Powder Technology. The expression " $D_{50}$ " is commonly used in this art.

Applicants aver that the claims fully comport with the requirements of 35 U.S.C. § 1.112.

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<sup>1</sup> Though the Office Action Summary lists claim 37 as rejected, claim 37 was subject to a restriction, and there is no mention of claim 37 in the body of the Office Action. Thus, it is clear that claim 37 has been withdrawn.

***Claim Rejections Under 35 U.S.C. § 103***

Claims 1, 7, 13, 27-32, and 35 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Delnick (U.S. Patent No. 5,948,464) in view of Maeda et al. (U.S. Patent Publication No. 2003/0113626). This rejection is traversed, and reconsideration and withdrawal thereof respectfully requested. The following is comparison between the invention as claimed and the cited prior art.

An aspect of the invention, per claim 1, is a lithium ion secondary battery comprising a porous film interposed between the positive electrode and the negative electrode. The porous film is adhered to a surface of at least one of the positive electrode and the negative electrode. The porous film comprises a filler and a resin binder and a content of the resin binder in the porous film is 1.5 to 8 parts by weight per 100 parts by weight of the filler. The resin binder comprises core-shell type rubber particles, and the rubber particles have an adhesive surface portion including at least an acrylonitrile unit, an acrylate unit, or a methacrylate unit.

Another aspect of the invention, per claim 27, is a lithium ion secondary battery comprising a porous film interposed between the positive electrode and the negative electrode. The porous film is adhered to a surface of at least one of the positive electrode and the negative electrode. The porous film comprises a filler and a resin binder and a content of the resin binder in the porous film is 1.5 to 8 parts by weight per 100 parts by weight of the filler. An amount of the resin binder is smaller in a first surface side where the porous film is in contact with the surface of the electrode, and larger in a second surface side opposite to the first surface side.

With respect to claim 1, the Office Action asserted that the rubber particles of Maeda et al. include acrylonitrile, acrylate, or a methacrylate and that the surface of the particles necessarily is adhesive because it is a binder. As regards claim 27, the Office Action averred

that the amount of resin binder on one side is necessarily smaller than the second side because the particles are so small that it is not possible to have equal amounts on both sides without a controlled method of applying the separator ink.

The combination of Delnick and Maeda et al. do not suggest the claimed lithium ion battery. Contrary to the Examiner's assertions, there is no suggestion or motivation to combine Maeda et al. and Delnick. Maeda et al. describe a long "laundry list" of binders for use in **battery electrodes**, an active component of the battery. There is no suggestion to select the specifically claimed binders for use in a **porous film**, an inactive component of the battery.

The claimed lithium ion secondary batteries are further distinguishable over Delnick and Maeda et al. Maeda et al.'s binder (composite polymer particle) is used by dispersing it in a liquid. That is, the binder is dispersed in a liquid that does not dissolve the binder. The binder is introduced into the electrode while maintaining the particulate condition (FIGs. 1 to 9). Maeda notes in paragraph [0053], "[t]he binder composition for battery electrode according to the present invention is obtained by dispersing the binder ... in a liquid material". Additionally, in paragraph [0055], it is noted, "the liquid material is one which ... is capable of preserving the shape of the composite polymer particle when a slurry for battery electrode ... is obtained by mixing the binder composition with an active material and others".

Delnick, on the other hand, is practiced by dissolving the binder in a liquid. The dissolved binder deposits on the coexisting particles when the solvent is vaporized to form the structure as shown in FIG. 2 of Delnick.

In column 4, lines 30 to 40, Delnick teaches, "[s]pecifically, a separator precursor solution is formulated as an ink comprised of a solid particulate material dispersed in a solution of a polymer binder which is dissolved in a suitable solvent. ... The polymer binder of the ink

solution may preferably comprise Polyvinylidene Fluoride-Hexafluoropropylene copolymer which is dissolved in BEEA [2(2Butoxy Ethoxy)Ethyl Acetate] solvent”. There is a clear distinction in Delnick between “a solid particulate material” which is “dispersed” and “a polymer binder” which is “dissolved”. Additionally, “Polyvinylidene Fluoride-Hexafluoropropylene copolymer” mentioned as a preferable binder is a common dissolving-type binder. It is further, it is noted in column 7, lines 42-44 of Delnick, “[t]he solvent to be utilized in the present invention can be any agent or mixture of agents which will dissolve the polymer binder”.

When the Maeda et al. binder is dissolved in a liquid, its particle structure is destroyed. Once the structure is destroyed, it is not reconstructed even though the binder is deposited. Maeda et al. notes in paragraph [0028], “[o]f these heterogeneous phase structures, a core-shell type heterogeneous structure (FIG.1) is preferable”. The core-shell structure, however, cannot be reconstructed once it is destroyed. Therefore, the binder of Maeda et al. cannot be used according to the teaching of Delnick.

As regards independent claim 27, there is no teaching in Delnick in view of Maeda et al. of the required concentration gradient of the resin binder. The Examiner has **no basis** for asserting that the amount of resin binder is necessarily smaller on one side versus the other side. As disclosed in the present specification (*see, e.g.*, Para. [0096] – [0109]), the amount of binder in any given portion of the porous film can depend on how the porous film is made.

Obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either explicitly or implicitly in the references themselves or in the knowledge readily available to one of ordinary skill in the art. *In re Kotzab*, 217 F.3d 1365, 1370 55 USPQ2d 1313, 1317 (Fed. Cir. 2000); *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed.

Cir. 1988); *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). There is no suggestion in Delnick and Maeda et al. to modify the battery of Delnick to provide a lithium ion secondary battery comprising a porous film interposed between the positive electrode and the negative electrode, wherein the porous film comprises a filler and a resin binder and a content of the resin binder in the porous film is 1.5 to 8 parts by weight per 100 parts by weight of the filler, and the resin binder comprises core-shell type rubber particles, and the rubber particles have an adhesive surface portion including at least an acrylonitrile unit, an acrylate unit, or a methacrylate unit, as required by claim 1; and the porous film comprises a filler and a resin binder and a content of the resin binder in the porous film is 1.5 to 8 parts by weight per 100 parts by weight of the filler, and an amount of the resin binder is smaller in a first surface side where the porous film is in contact with the surface of the electrode, and larger in a second surface side opposite to the first surface side, as required by claim 27.

The mere fact that references can be combined or modified does not render the resulting combination obvious unless the prior art also suggests the desirability of the modification. *In re Mills*, 916 F.2d 680, 16 USPQ2d 1430 (Fed. Cir. 1990). Applicants submit that Maeda et al. does not suggest the arrangement of the porous film as alleged by the Examiner.

As, explained above, the binder of Maeda et al. cannot be used according to the teaching of Delnick. Substituting the dispersion of Maeda et al. into the Delnick porous film formation process would render the Delnick's method of forming the porous film unsuitable for its intended purpose. If a proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification. *In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984); MPEP § 2143.01.

The only teaching of the claimed lithium ion secondary batteries wherein the porous film comprises a filler and a resin binder and a content of the resin binder in the porous film is 1.5 to 8 parts by weight per 100 parts by weight of the filler, and the resin binder comprises core-shell type rubber particles, and the rubber particles have an adhesive surface portion including at least an acrylonitrile unit, an acrylate unit, or a methacrylate unit, as required by claim 1; and the porous film comprises a filler and a resin binder and a content of the resin binder in the porous film is 1.5 to 8 parts by weight per 100 parts by weight of the filler, and an amount of the resin binder is smaller in a first surface side where the porous film is in contact with the surface of the electrode, and larger in a second surface side opposite to the first surface side, as required by claim 27 is found in Applicants' disclosure. However, the teaching or suggestion to make a claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

Although the Examiner alleged that that the amount of resin binder on one side is necessarily smaller than the second side because the particles are so small that it is not possible to have equal amounts on both sides without a controlled method of applying the separator ink, the Examiner's conclusion lacks the requisite factual support. The Examiner's retrospective assessment of the claimed invention and use of unsupported conclusory statements are not legally sufficient to generate a case of prima facie obviousness. The motivation for modifying the prior art must come from the prior art and must be based on facts. The Examiner is not free to ignore the judicial requirement for **facts**. To do so is legal error. *In re Lee*, 277 F.3d 1338 (Fed. Cir. 2002).

Claims 14 and 36 were rejected as being unpatentable over Delnick in view of Maeda et al. and further in view of Murai et al. (U.S. Patent Publication No. 2002/0048704). This rejection is traversed, and reconsideration and withdrawal thereof respectfully requested.

The Office Action asserted that Delnick modified by Maeda et al. teach a porous film but do not teach a porous film and a separator. The Office Action relied on Murai et al. to cure the deficiencies of Delnick and Maeda et al. The Office Action concluded that Murai et al. teach a separator made of an electrically insulating material that has sufficient strength, such as porous film.

The combination of Delnick, Maeda et al., and Murai et al. does not suggest the claimed lithium ion secondary batteries because Murai et al. do not cure the deficiencies of Delnick and Maeda et al. Murai et al. do not suggest the resin binder comprising core-shell type rubber particles, as required by claim 1, and the binder concentration gradient required by claim 27.

Claims 5 and 21-25 were rejected as being unpatentable over Delnick in view of Maeda et al. and further in view of Sheibley (U.S. Patent No. 4,371,596)<sup>2</sup>. This rejection is traversed, and reconsideration and withdrawal thereof respectfully requested.

The Office Action acknowledged that Delnick does not disclose the filler comprising a mixture of a large particle group and a smaller particle group. The Office Action relied on Sheibley to cure the deficiencies of Delnick and Maeda. The Office Action averred that Sheibley teaches a separator comprising a filler material with two distinct particle sizes.

The combination of Delnick, Maeda et al., and Sheibley does not suggest the claimed lithium ion batteries. Claim 5 is allowable for at least the same reasons as independent claim 1, as Sheibley does not suggest a resin binder including core-shell type rubber particles.

Additionally, Sheibley is directed to an aqueous electrolyte zinc anode based batteries, not non-

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<sup>2</sup> The Office rejected claim 5 and claims 21-25 in two separate rejections.

aqueous electrolyte lithium ion batteries of the present application. As is noted in column 1, lines 16 to 22 in Sheibley, Sheibley relates to Ag-Zn and Ni-Zn alkaline batteries. These alkaline batteries have totally different characteristics from those of lithium ion secondary batteries, and the structure, charge and discharge voltage range, electrolyte composition, and electrode composition are totally different as well. Therefore, one of skill in this art would not combine Sheibley and Delnick. One of skill in the art of non-aqueous lithium ion secondary batteries would not look towards aqueous alkaline batteries to solve a problem with a non-aqueous lithium ion secondary battery.

With respect to independent claim 21, the Office Action concluded that the combination of Delnick modified by Maeda and Sheibley would necessarily have an elongating percentage of the porous film of 15% or more.

The stress tolerance of the porous film of the present application depends on the elongating percentage (*see, e.g.*, Para. [0016] of the present specification). The cited references do not suggest the unexpected improvement of reliability of the battery by controlling the elongating percentage of the porous film (*see, e.g.*, Para. [0016] of the present specification). Table 4 of the present specification, for example, shows that when the amount of resin binder in the porous film is small, the porous film peels, and the porous film with sufficient elongating percentage can not be obtained (*see, e.g.*, Para. [0194] of the present application). Therefore, none of the references, individually or combined, suggest an elongating percentage of the porous film is 15% or more, as required by claim 21.

Furthermore, as explained above, it would not have been obvious to combine Sheibley and Delnick. For example, the required tolerance for the porous film of alkaline batteries (the porous film being in an electrolyte comprising KOH aqueous solution) and the porous film of



lithium ion secondary batteries (the porous film being in a non-aqueous electrolyte) is different. It is clear that the elongating percentage of the porous film of lithium ion secondary batteries is not obvious, when the teaching of Sheibley is considered as a whole.

Claim 26 was rejected as being unpatentable over Delnick in view of Maeda et al. and further in view of Sheibley and Murai et al. This rejection is traversed, and reconsideration and withdrawal thereof respectfully requested.

The Office Action acknowledged Delnick, Maeda et al, and Sheibley do not teach a porous film and a separator. The Office Action relied on Murai et al. to cure the deficiencies of Delnick, Maeda et al., and Sheibley.

Claim 26 is allowable for at least the same reasons as claim 21, as Murai et al. do not cure the deficiencies of Delnick, Maeda et al., and Sheibley.

Claims 16-19 were rejected as being unpatentable over Delnick in view of Maeda et al. and Call (U.S. Patent Publication No. 2002/0136945). This rejection is traversed, and reconsideration and withdrawal thereof respectfully requested.

The Office Action acknowledged that Delnick and Maeda et al. do not teach an average pore size of micropores in the porous film is 0.02 to 0.09  $\mu\text{m}$ . The Office Action relied on Call to cure the deficiencies of Delnick and Maeda et al. Call teaches a microporous separator having a pore size of 0.01 to 5  $\mu\text{m}$ .

The claimed lithium ion secondary battery is not suggested by the asserted combination of Delnick, Maeda et al., and Call. As explained above, Maeda et al. describe a long “laundry list” of binders for use in **battery electrodes**, an active component of the battery. There is no suggestion to select the specifically claimed binders for use in a **porous film**, an inactive component of the battery.

The claimed lithium ion secondary batteries are further distinguishable over Delnick and Maeda et al. Maeda et al.'s binder (composite polymer particle) is used by dispersing it in a liquid. That is, the binder is dispersed in a liquid that does not dissolve the binder. The binder is introduced into the electrode while maintaining the particulate condition (FIGs. 1 to 9). Maeda notes in paragraph [0053], “[t]he binder composition for battery electrode according to the present invention is obtained by dispersing the binder ... in a liquid material”. Additionally, in paragraph [0055], it is noted, “the liquid material is one which ... is capable of preserving the shape of the composite polymer particle when a slurry for battery electrode ... is obtained by mixing the binder composition with an active material and others”.

Delnick, on the other hand, is used by dissolving the binder in a liquid. The dissolved binder deposits on the coexisting particles when the solvent is vaporized to form the structure as shown in FIG. 2 of Delnick.

Further, there is no suggestion of combining the alleged teachings of Call with Delnick and Maeda et al. Call teaches a polymer separator, not a porous film with 1.5 to 8 parts by weight of the resin binder. The separator of Delnick is entirely or substantially entirely a polymer resin, not only 1.5 to 8 parts by weight of resin binder. There is no suggestion that the claimed porosity would result if the separator of Call were substituted for the resin binder of Delnick. On the other hand, if the separator of Call were substituted for the porous film in Delnick in view of Maeda et al., the porous film would not have the claimed filler content and would not include the specifically claimed binder.

Claim 20 was rejected as being unpatentable over Delnick in view of Maeda et al. and Call, and further in view of Murai et al. The Office Action acknowledged that Delnick, Maeda et al., and Call do not teach a porous film and a separator. The Office Action also acknowledged

that Delnick and Maeda et al. do not teach a wound battery. The Office action relied on Murai et al. to cure the deficiencies of Delnick, Maeda et al., and Call.

Claim 20, however, is allowable for at least the same reasons as independent claim 16. Murai et al. do not cure the deficiencies of Delnick, Maeda et al., and Call, as Murai et al. do not suggest selecting the specifically claimed binders for use in the claimed porous film, as required by claim 16.

The dependent claims are allowable for at least the same reasons as the respective independent claims from which they depend and further distinguish the claimed lithium ion secondary batteries.

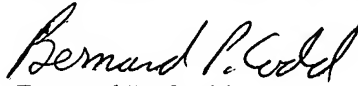
In view of the above amendments and remarks, Applicants submit that this application should be allowed and the case passed to issue. If there are any questions regarding this Amendment or the application in general, a telephone call to the undersigned would be appreciated to expedite the prosecution of the application.

**Application No.: 10/551,934**

To the extent necessary, a petition for an extension of time under 37 C.F.R. § 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account 500417 and please credit any excess fees to such deposit account.

Respectfully submitted,

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